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Subject = Engineering Mechanics
Assignment No = Final term
Department = Civil Engineering
Section = A

QNo5, Explain work, energy and power in details along with practical example from daily life?

Ans Work:-

The application of a Force through certain distance is known as work. it measured in Joules (J)

Formula:-

Work = Force x Distance travelled in direction of Force

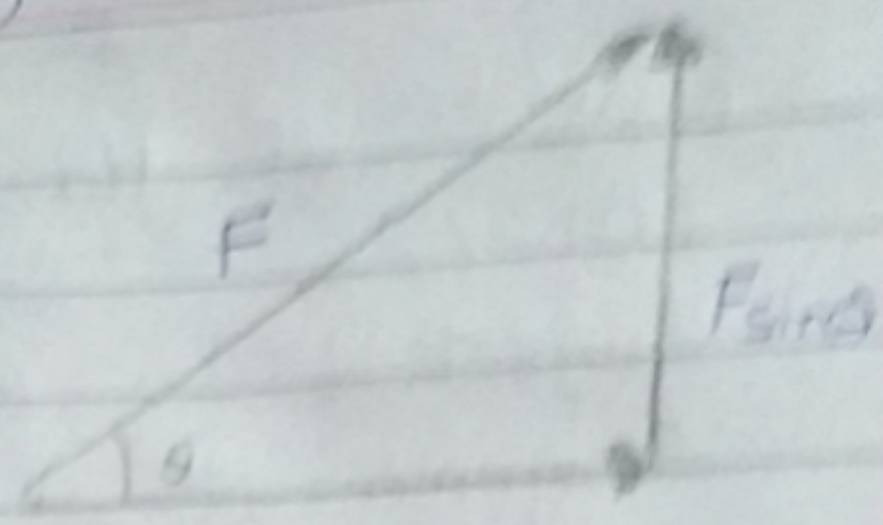
$W = F.d$

W is the work done (J)
F is the Force applied (N
d is the distance (M)

Calculating work done at angle θ:-

When calculating the work done by Force acting at an angle, it is useful to break the Force down into components.
The tension in the rope can be broken down into horizontal and a vertical component.
The vertical component does no work because the box does not move in that direction.

(2-10)



So to calculate work done by force at an angle,

Workdone = Force in direction of moment x distance moved

$W = F s \cos\theta$

Example:-

A Freshman lifting a backpack Full of book upon her shoulder.

Energy:-

Is the measure of the ability of an object or a system to perform work.

Unit:-

Its Unit is Joule and denoted by J

There are many types of energy:-

Kinetic energy:-

Energy of an object due to its speed.

Gravitational potential energy:-

Energy of an object due to ~~positive~~ position in a gravitational field.

Elastic potential energy:-

Energy stored when an object is stretched or compressed

Chemical Energy:-

Energy stored in chemical bond.

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Nuclear Energy:-

Energy stored in nuclei.

Heat Energy:-

Hot things have more energy than their counterparts.

Formula:-

$W = Fxd.$

Example:-

An example is a child swinging on a swing. No matter whether the swing sits moving forward or backward

Power:- Power is the rate at which work is done, on the rate at which energy is transferred.

Formula:-

Power = work done / time taken

$P = W/t$

where

P is measured in watts

work done are energy transferred is measured in Joules J

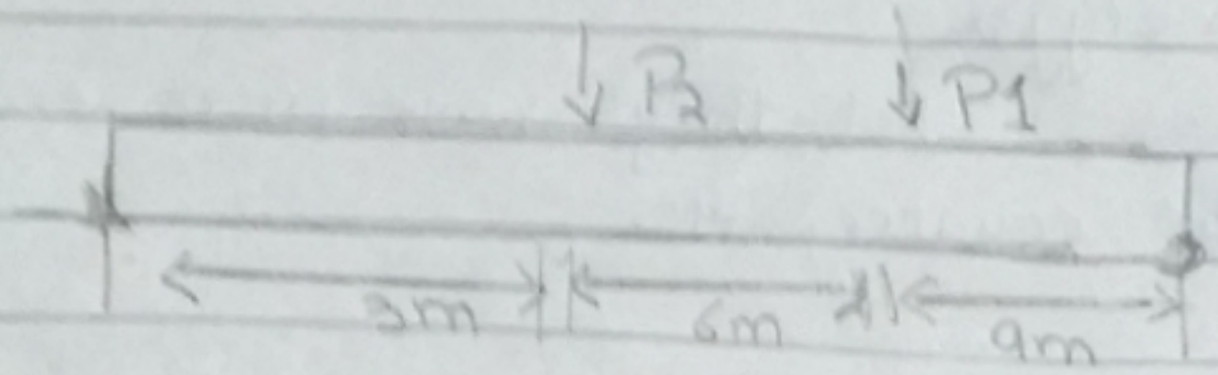
time is measured in seconds.

Example:-

- An example of power is the functioning of a gasoline - driven saw or tool
- An example of power is a big game move.

(4-10)

Q4 Find the support reaction. Show all calculation
(P1 = 200 + IDNo), (P2 = 500 + IDNo)



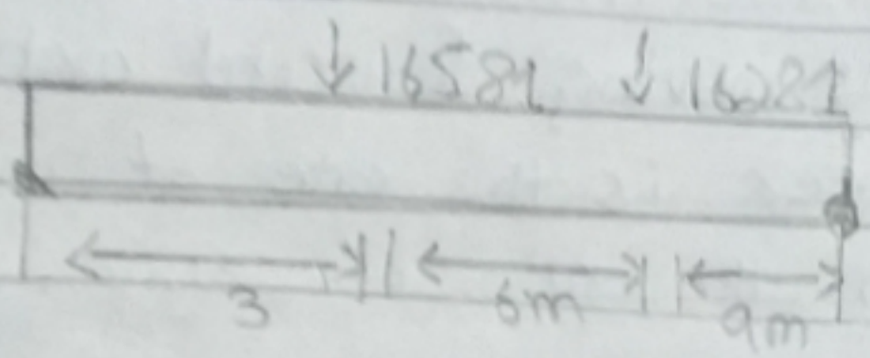
Solution:

$P_1 = 200 + 16081$

$P_1 = 16281$

$P_2 = 500 + 16081$

$P_2 = 16581$



$R_{1x} = 0$ Summation $Fx = 0$

$R_{1y} + R_{2y} - 16281 - 16581 = 0$ Summation $Fy = 0$

$R_{1y} + R_{2y} = 16281 + 16581$

$R_{1y} + R_{2y} = 32862$ —eqn1

$R_{1x} = [(16581 \times 15 + 16281 \times 9) / 18$

$248715 + 146,529 / 18$

$395,244 / 18$

R_{1x} 21,958 N

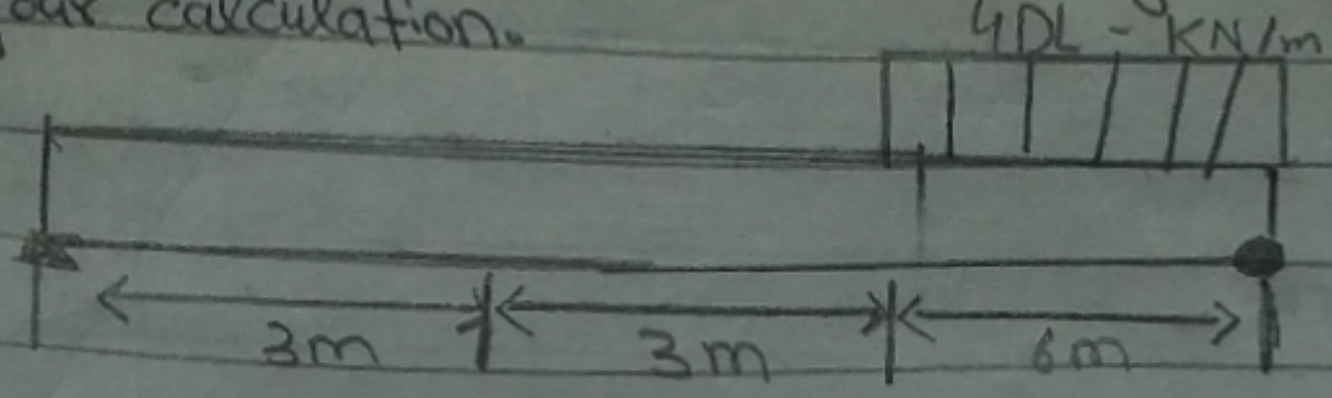
$R_{2x} = [32862 - 21958]$

$R_{2y} = 10904 N$

$R_{1x} = 0 - N$	$R_{1y} = 21958 N$	$R_{2y} = 10904 N$

(5-10)

Q2) DRAW the neat Shear Force diagram. Show all your calculation.



Solution:-

$\Sigma F_y = 0$

clock wis counter clock wise

$(R_1 \times 12) = [(6 \times 16231)(\frac{6}{2}) + (16181 \times 9$

$R_1 \times 12 = 97386 (\frac{6}{2}) + 145,629$

$\frac{R_1 \times 12}{12} = \frac{292158 + 145629}{12}$

$\boxed{R_1 = 36,482.25}$ KN

$R_1 + R_2 =$ total load

$R_2 = [(16231 \times 6 + (16181] - 36482.25$

$97,386 + 16181] - 36482.25$

$113,567 - 36482.25$

$\boxed{R_2 = 77,084.75}$ KN

SHEAR Force:-

S.F at A = RA = 36482.25

S.F at B = 36482.25 - 16181

$R_B = 20,301.25$

S.F at C = 20301.25 - (16231 x 6)

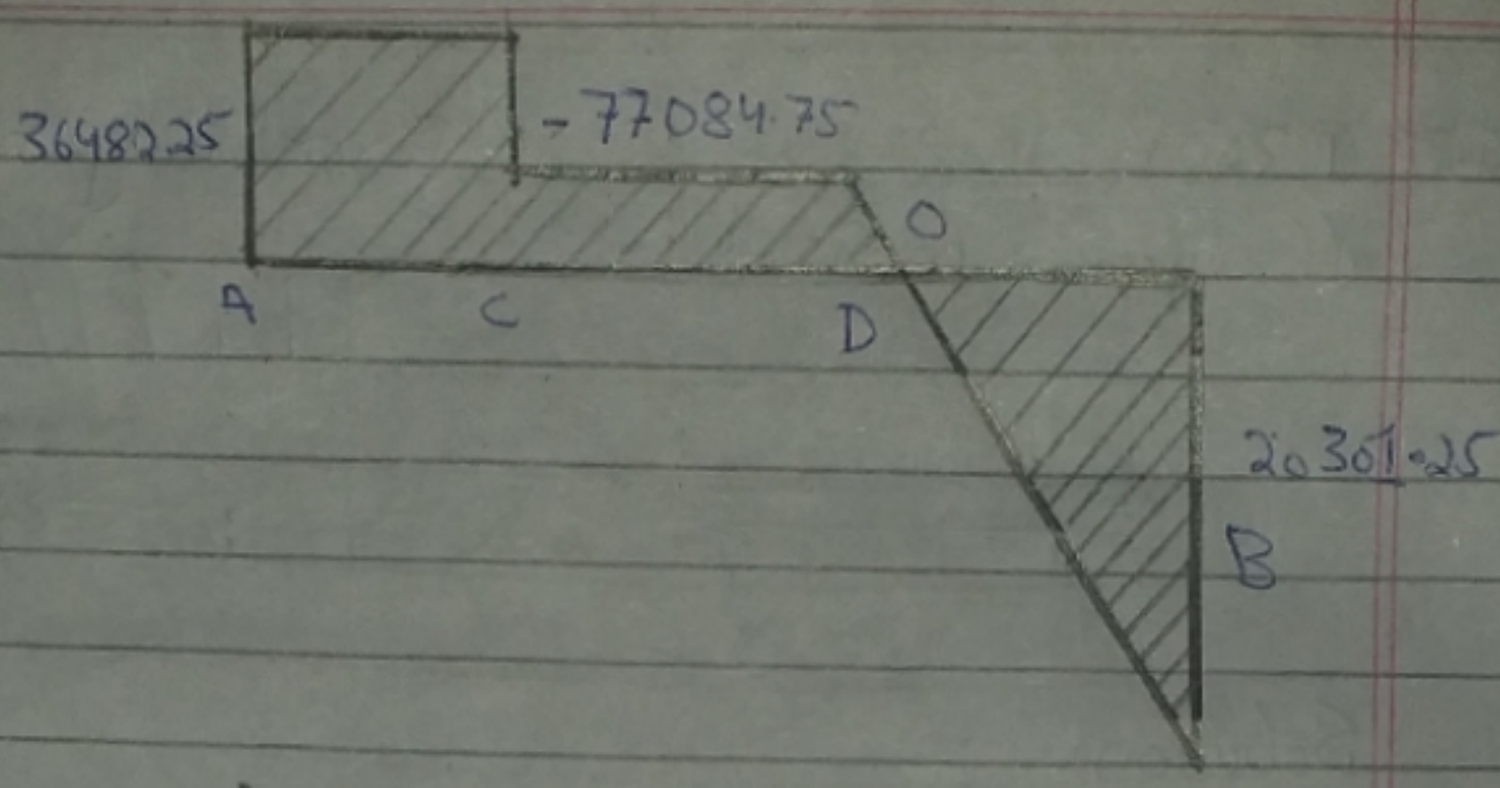
20301.25 - 97,386

S.F at C = -77,084.75

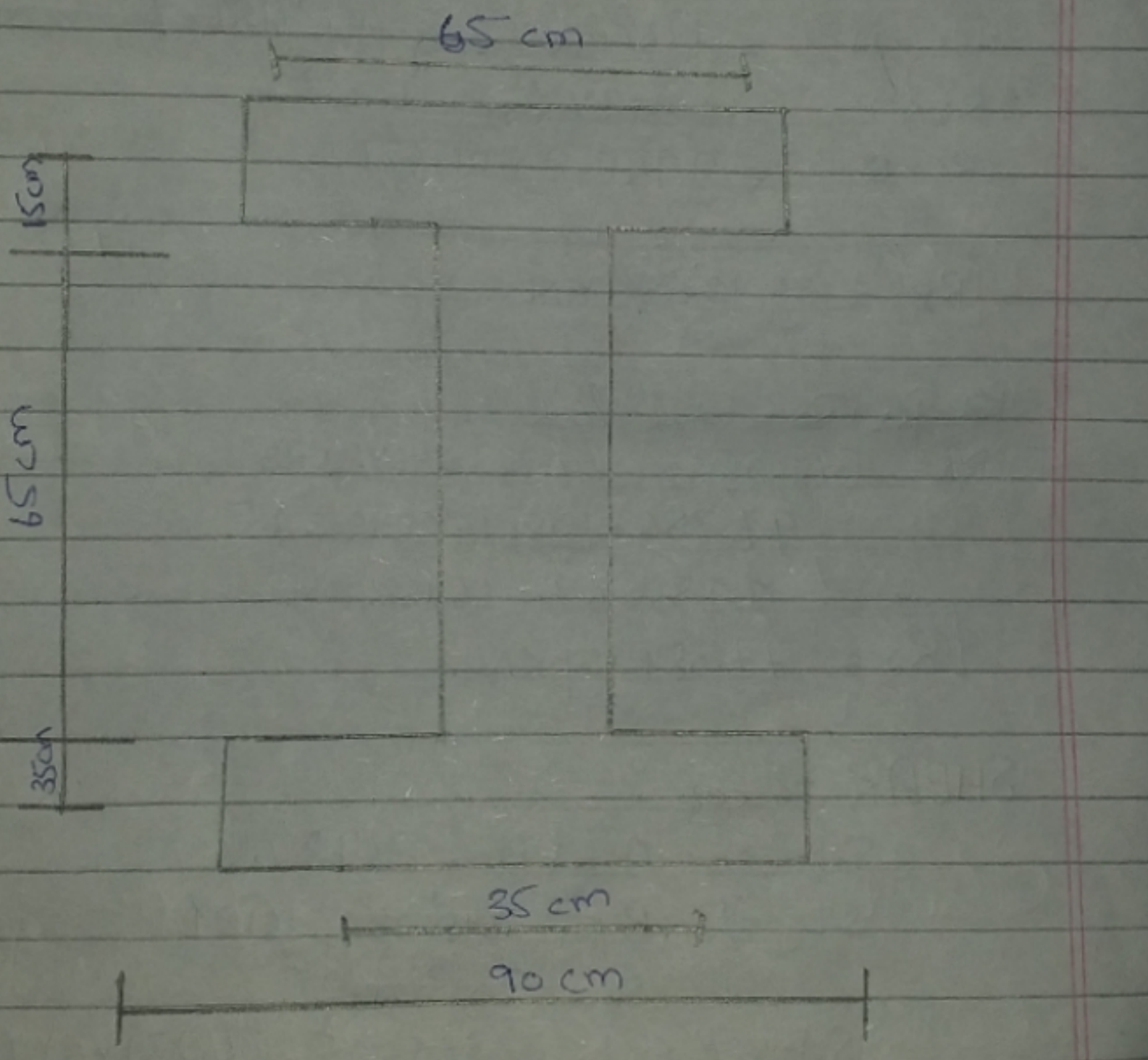
S.F at D = -77084.75 + 77084.75

S.F at D = 0

(6-10)



Find the centroid of the given shape. Show all calculation



Solution:-

(7-10)

Position	Shape	Area	centroid distance yaxis	Moment of area cy
1)	Rec	90x35 = 3150	$\frac{35}{2}$ = 175cm	55125
2)	Rec	65x35 = 2275	$\frac{65}{2}+35$ = 175cm	153,5625
3	Rec	65x35 = 975	$\frac{75}{2}+100$ = 175cm	104,8125
		Eq = 6400		Eqy = 313,500

$$y = \frac{Eay}{Eq} = \frac{313,500}{6400} = 48.984$$

~~b) b)~~

b(b):- Find mid area (35cm x 65cm) only Find moment of inertia, Radius of Gyration and Section modulo

Moment of inertia:-

$$\text{Moment of inertia} = \frac{Bd^3}{12}$$

$B = 65 \quad d = 35$

$$\frac{65 \times (35)^3}{12} = \frac{2786875}{12}$$

$$\frac{2786875}{12} = \boxed{232,239.58}\ cm^4 \text{ Moment of inertia.}$$

Mid area:-

$$65 \times 35cm = 2275cm^2$$

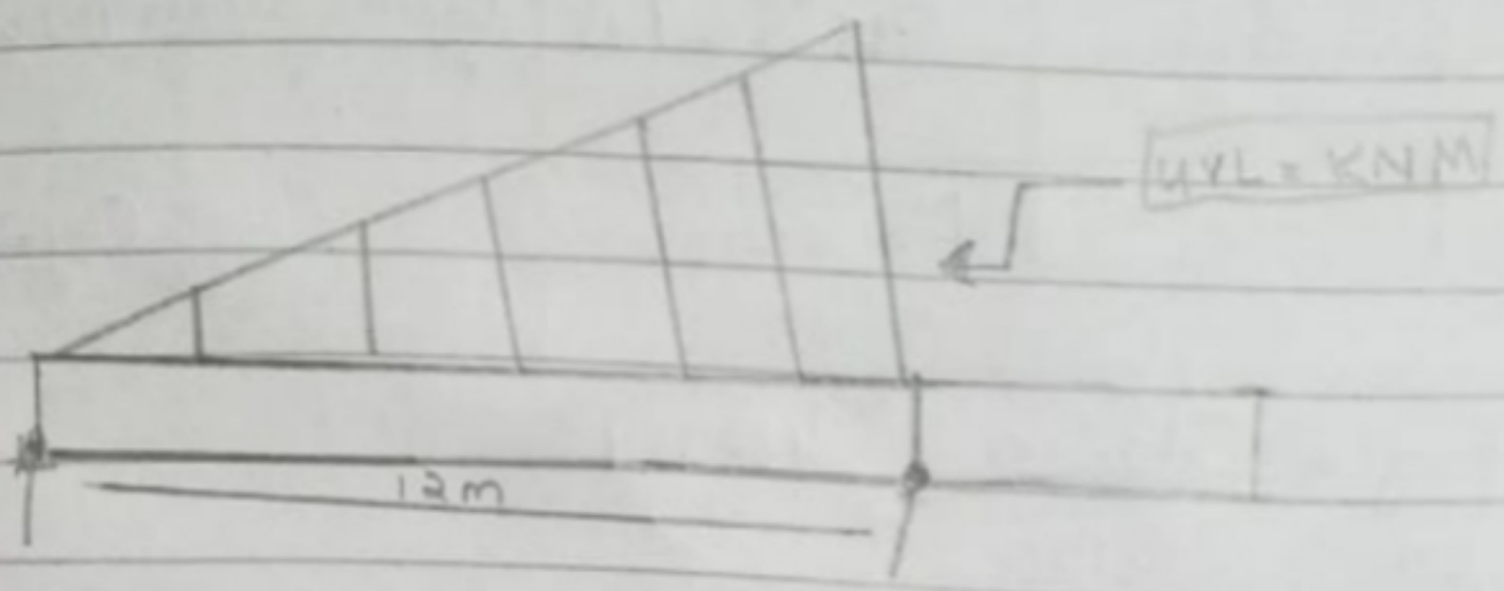
Radius of ~~Gyration~~:- Gyration.

$$K = \sqrt{\frac{I}{A}} =$$

$$K = \sqrt{\frac{I}{A}} = \sqrt{\frac{232,239.5}{2275}} = \boxed{10.10}$$ Ans.

Q3) Draw the neat shear force and bending movement diagram.

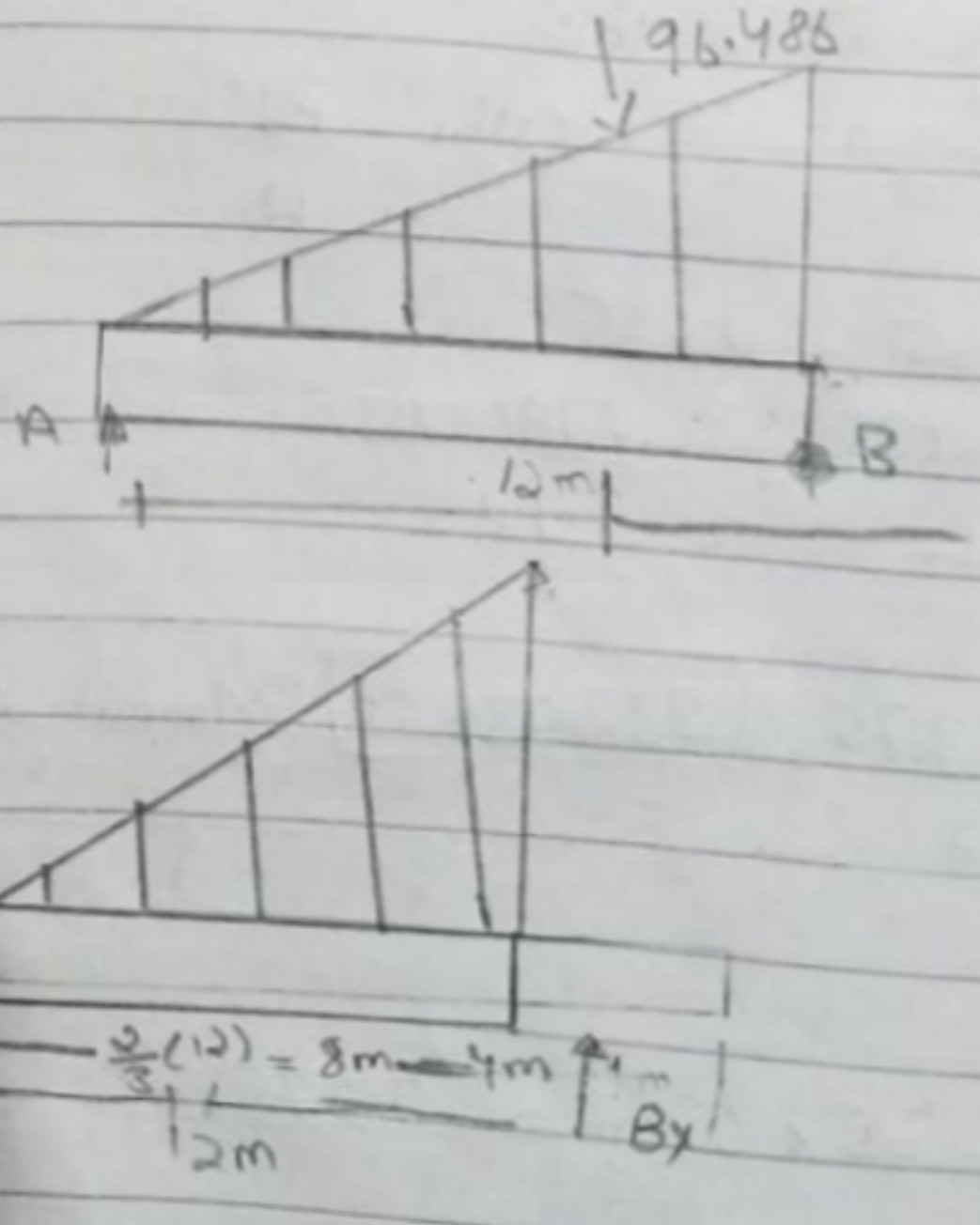
(.UVL = Student ID No / 1000.



Solution

$$UVL = \frac{16081}{1000} = \underline{16.081}$$

UVL Point Load $16.081 \times 12 \times \frac{1}{2} = 96.486$



Support Reaction:-

$$\Sigma Fx = 0 \Rightarrow Ax = 0$$

$$\Sigma Fy = 0 \Rightarrow Ax + By = 96.486\ KN \quad -(1)$$

$$\Sigma MA = 0 \Rightarrow (By \times 12) - (96.486 \times 8) = 0$$

$$By \times 12 = 771.88$$

$$By = \frac{771.88}{12}$$

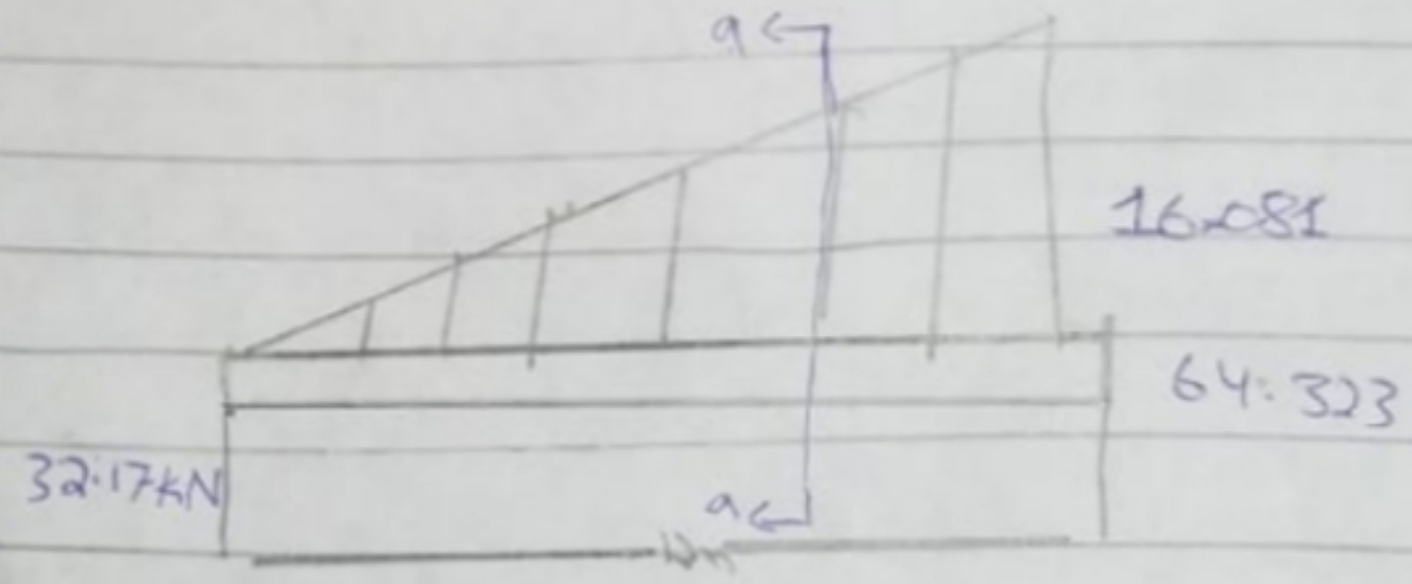
$$By = 64.3283.$$

$$Ay + 64.323 = 96.486.$$

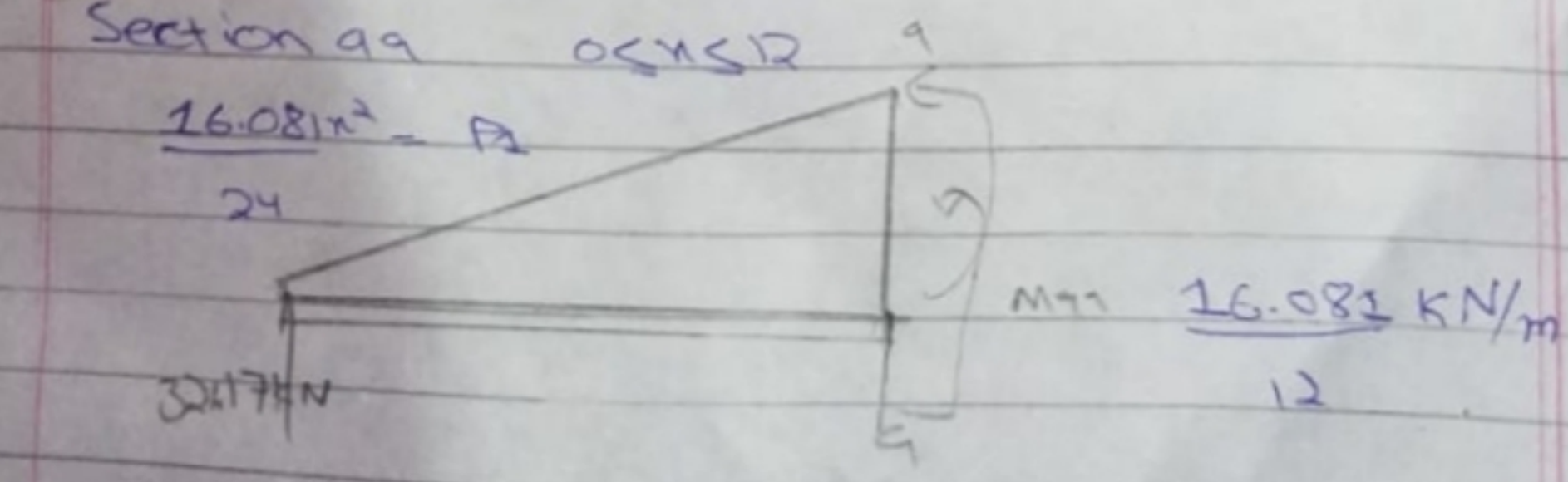
$$Ay = 96.486 - 64.323$$

$$\boxed{Ay = 32.163\ KN}$$

Shear force and Bending Moment at different Section.



Section 99 $0 \leq x \leq 12$



Law of

From similar Δs

$$\frac{16.081}{12} = \frac{W_0\ KN/m}{x}$$

$$\Rightarrow \boxed{W_0 = \left(\frac{16.081\ KN/m}{12}\right)}$$

(10-10)

$Fy=0 \Rightarrow -V_{QA} - \frac{16.08 x^2}{24} + 32.163$

$$V_{QA} = 32.163 - \frac{16.08 x^2}{24} \quad \text{--- 9}$$

At $x=0 \Rightarrow V_{QA} = 32.163\ KN$

At $x=12 \Rightarrow V_{QA} = -64.34\ KN$

$0 = 32.17 - \frac{16.08 x^2}{12} \quad x = 1.3400$

At $x = 1.3400 \Rightarrow V_{QA} = 0\ KN$

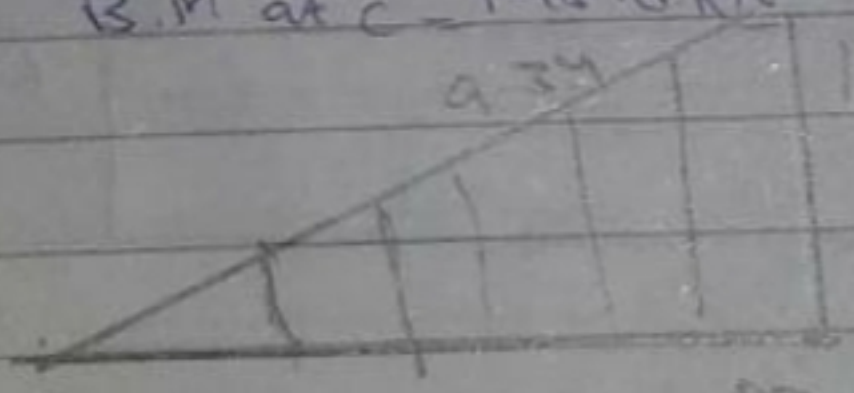
Bending moment

B.M. at A & B

B M at C $= (32.162 \times 6.9) - \frac{1}{2} \times 6.9 \times 6.9 \times \frac{6.9}{3}$ (9.24)

$= 22.91 - 73.31$

B.M at C $= 148.6\ KN$



A

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